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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/582,459	05/16/2007	Paul Wallace	14113-00040-US	1128
23416 7590 09/01/2010 CONNOLLY BOVE LODGE & HUTZ, LLP P O BOX 2207 WILMINGTON, DE 19899				
EXAMINER				
CLARK, GREGORY D				
ART UNIT		PAPER NUMBER		
1786				
MAIL DATE		DELIVERY MODE		
09/01/2010		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/582,459

**Applicant(s)**

WALLACE ET AL.

**Examiner**

GREGORY CLARK

**Art Unit**

1786

**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 23 August 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) 6, 8, 11 and 12 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7, 9-10 and 13-27 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/S508)
- Paper No(s)/Mail Date \_\_\_\_\_

- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

### **DETAILED ACTION**

The examiner acknowledges the receipt of applicants' arguments dated 08/23/2010. Claims 1-5, 7, 9-10, 13-27 pending.

Applicant's request for reconsideration of the finality of the previous office action was persuasive and, therefore, the finality of the previous action is withdrawn.

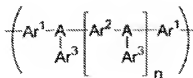
Rejections and objections made in previous office action that do not appear below have been overcome by applicant's amendments and therefore the arguments pertaining to these rejections/objections will not be addressed.

### **Claim Rejections - 35 USC § 103**

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

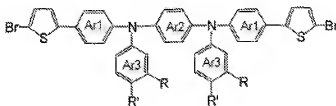
1. **Claims 1-5, 7, 9-10, 13-18, 20, 24 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable by Towns (WO 03/035714).**
2. **Regarding Claims 1-3, 24-27, the applicant claims an optionally substituted oligomer of polymer comprising a repeat unit of Formula 1:**



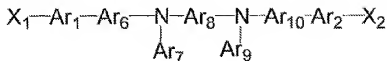
Formula 1

Wherein n is at least 1; each A is N or P; each Ar<sup>1</sup> and Ar<sup>3</sup> is arylene or heteroarylene; Ar<sup>2</sup> is arylene or heteroarylene containing a linking ring to which the two A atoms are both directly linked and at least one of Ar<sup>1</sup> or Ar<sup>2</sup> is substituted with at least one substituent. Applicant further claims a second repeating unit wherein the second repeat unit is selected from optionally substituted phenyl, fluorene, spirobifluorene, indenofluorene, heteroaryl or dihydrophenanthrene.

Towns discloses an oligomeric material where the first repeat unit is represented by formula T-1 (page 4):



Formula T-1 shows n = 1, N corresponds to applicants' A group, Ar<sup>1</sup> corresponds to applicants' Ar<sup>1</sup>, Ar<sup>2</sup> corresponds to applicants' Ar<sup>2</sup> and Ar<sup>3</sup> corresponds to applicants' Ar<sup>3</sup>. The Ar<sup>2</sup> linking group connects both N atoms. Formula T-1 is a specific example of generic Formula T-1A (page 3):



wherein  $X_1$  and  $X_2$  are the same or different polymerisable groups and wherein  $Ar_1$ ,  $Ar_2$ ,  $Ar_6$ ,  $Ar_7$ ,  $Ar_8$ ,  $Ar_9$ ,  $Ar_{10}$  are the same or different substituted or unsubstituted aryl or

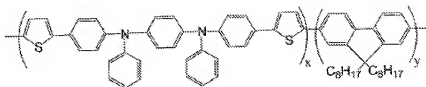
heteroaryl groups. Examples of groups  $Ar_1$ ,  $Ar_2$ ,  $Ar_3$ ,  $Ar_4$ ,  $Ar_5$ ,  $Ar_6$ ,  $Ar_7$ ,  $Ar_8$ ,  $Ar_9$ , and  $Ar_{10}$  include such groups as phenylene, thiophene, pyrrole, furan, pyridine and biphenylene.

The aryl or heteroaryl groups  $Ar_3$ ,  $Ar_4$ ,  $Ar_5$ ,  $Ar_6$ ,  $Ar_7$ ,  $Ar_8$ ,  $Ar_9$ , and  $Ar_{10}$  may be substituted with moieties selected from the group comprising alkyl, perfluoroalkyl, alkylaryl, arylalkyl, heteroaryl, aryl, alkoxy, aryloxy and thioalkyl. Preferred substituents are butyl and sec-butyl.

Formula T-1A shows that  $Ar_6/Ar_8$  and  $Ar_9/Ar_7$  which correspond to  $Ar_1$ ,  $Ar_2$  and  $Ar_3$  in applicants' Formula 1 can be a perfluoroalkyl substituent (per claim 2-3 and 24-26) (page 4).

As Towns discloses Formula(s) T-1 and T-1A which encompass applicants' Formula 1 where each of the Ar groups can be substituted with a perfluoroalkyl substituent, it would have been obvious for a person of ordinary skill in the art to have made a series of monomers with varying location of the substitution at  $Ar_6$ - $Ar_{10}$  which would have included perfluoroalkyl substitution at  $Ar_6/Ar_8$  and  $Ar_9/Ar_7$  position which read on the instant limitations.

Towns also discloses that Formula T-1 can also be a part of the copolymer T-2 (page 11):



Copolymer T-2 shows the second repeat unit is a fluorenyl monomer (per claims 1 and 27).

3. **Regarding Claims 4 and 5**, Formula T-1 shows Ar1-Ar3 as phenyl groups.
4. **Regarding Claims 7 and 9**, copolymer T-2 shows the monomer 1 conjugated to monomer 2 (per claim 7) and Ar3 can be substituted with an alkyl group or perfluoroalkyl group (page 4) (per claim 9).
5. **Regarding Claim 10**, Towns discloses a blend of copolymer T-2 and another organic compound (page 13). Copolymer T-2 can be used as hole transporting material (page 2).
6. **Regarding Claims 13 and 14**, Towns show that Formula T-1 (shown above) can have bromide as a leaving group (LG) (page 4). Copolymer T-2 (above) shows the second repeat unit is a fluorenyl monomer. Formula T-1 shows  $n = 1$ , N corresponds to applicants' A group, Ar1 corresponds to applicants' Ar1, Ar2 corresponds to applicants'

Ar2 and Ar3 corresponds to applicants' Ar3. The Ar2 linking group connects both N atoms. Ar3 can be substituted with an alkyl group or perfluoroalkyl group (page 4).

The reactions can be catalyzed by palladium (variable oxidation state metal) (page 6) (per claim14).

7. **Regarding Claim 15**, Towns discloses that reactions can be catalyzed by palladium (variable oxidation state metal) (page 6) in the presence of a base (page 8).

8. **Regarding Claim 16**, Towns discloses that in a monomer one LG can be a reactive boron group and the other LG can be a halogen (page 8).

9. **Regarding Claims 17-18 and 20**, Towns discloses that the polymers or blend (page 13) (per claim 18) can be used in an optical device which can be an electroluminescent device (page 12) (per claims 17 and 20). The polymers or blend is located between two electrodes (page 13) (per claim19).

10. **Claims 21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Towns (WO 03/035714) in view of Allen (US 6,858,703).**

11. **Regarding Claim 21 and 23**, Towns discloses that the copolymers can be used in an electroluminescent device (pages 12 and 13) but fails to mention a switching device.

Allen discloses that triarylamine polymers are used in optical sensor, switching devices and field effect transistors (column 83, lines 20-30).

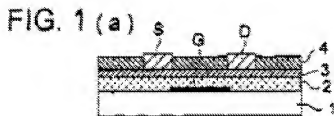
It would have been obvious to a person of ordinary skill in the art at the time of the invention to have used the electroluminescent device of Towns in applications taught by the prior art which would have included the applications disclosed by Allen which reads on applicants' claimed applications.

**12. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Towns (WO 03/035714) in view of Allen (US 6,858,703) and further in view of Hirai (US 6,740,900).**

**13. Regarding Claim 22,** Towns in view of Allen disclose triarylamine polymers used as a field transistors but fail to mention the structure of the device.

Hirai discloses that an insulator layer can be placed in various locations with respect to the gate, drain and source electrodes in an organic thin-film transistor.

Hirai discloses that the organic thin-film transistor contains a organic semiconductor layer 3, a gate electrode G, a drain electrode D, and a source electrode S that are in Figure I(a) shown below:



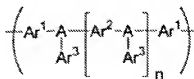
Hirai further discloses that a dielectric layer (field-effect transistor) serves as gate insulation layer 2 (column 7, lines 44-45). The above figure shows that the gate electrode G and the organic semiconductor layer 3 are both in contact with the gate insulation layer 2 located on side one. In addition, the above figure shows that the source electrode S and the drain electrode D are located on the organic semiconductor layer 3 on side two.

Hirai shows in the prior art that the claimed structure can be used as a field effect transistor.

With the reasonable expectation of success a person with ordinary skill in the art at the time of the invention would have selected from known field-effect transistor structures and readily substituted the conductive polymers disclosed by Towns (T-2) for the organic semiconductive layer 3 disclosed by Hirai in Figure 1 (a) since the conductive polymers of Towns would be functional equivalents to the polymers typically used to make an organic semiconductive layer.

14. **Claims 1-5, 7, 9-10, 13, 17, 19-20 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Antoniadis (US 5,948,552) in view of Bradley (Advanced Materials, 1999, Vol. 11, No. 3, pages 241-246).**

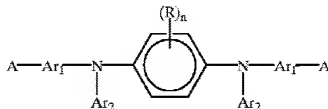
15. **Regarding Claims 1, 7 and 27**, the applicant claims an optionally substituted oligomer or polymer containing a repeat unit of Formula 1:



Formula 1

Wherein n is at least 1; each A is N or P; each Ar<sup>1</sup> and Ar<sup>3</sup> is arylene or heteroarylene; Ar<sup>2</sup> is arylene or heteroarylene containing a linking ring to which the two A atoms are both directly linked and at least one of Ar<sup>1</sup> or Ar<sup>2</sup> is substituted with at least one substituent.

Antoniadis discloses formula A-1 (column 9, line 45):

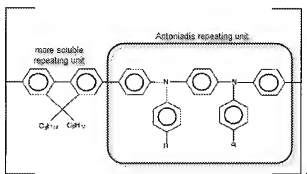


Art Unit: 1786

Formula A-1 shows  $n = 1$ , N corresponds to applicants' A group, Ar1 corresponds to applicants' Ar1, Ar2 corresponds to applicants' Ar3 and the phenyl linking group corresponds to applicants' Ar2. The phenyl linking group connects both N atoms.

Antoniadis fails to mention a second repeating unit wherein the second repeat unit is selected from optionally substituted phenyl, fluorene, spirobifluorene, indenofluorene, heteroaryl or dihydrophenanthrene.

Bradley discloses that fluorene-triarylamine copolymers offer some advantages over a purely triarylamine based system. Bradley teaches that when N,N'-diphenyl, N,N'-bis(3-methylphenyl)-(1,1'-diphenyl)-4,4'-diamine (TPD) is combined with a more soluble polymer (fluorene based) the resulting copolymer is more processible and has a higher hole mobility (page 242). The copolymers can be represented by the Formula B-1:



Formula B-1 disclosed by Bradley shows the same triarylamine based repeating unit as Antoniadis copolymerized with a fluorene derivative which is a more soluble repeating unit. Copolymer B-1 shows monomer 1 in conjugation with monomer 2 (per claim 7) and the second monomer is fluorenyl (per claim 27).

As Bradley teaches that such copolymer produce higher hole mobility than polymers with only the triarylamine component present, one could envisage adding a more soluble monomeric species to the polymers of Antoniadis to improve the processibility and promote higher hole mobility.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to have modified the polymers of Antoniadis by adding the more soluble repeating units (fluorenyl) of Bradley since Bradley teaches that the resulting copolymer that read on the instant limitation improve processibility and hole mobility properties.

16. **Regarding Claims 13-14**, Antoniadis discloses Formula A-1 above where A can be a halogen atom (column 4, lines 21-22) which corresponds to applicants' LG group in Formula II (claim 13),  $n = 1$ , N corresponds to applicants' A group, Ar1 corresponds to applicants' Ar1, Ar2 corresponds to applicants' Ar3 and the phenyl linking group corresponds to applicants' Ar2 linking both N atoms. The reactions can be catalyzed by palladium (variable oxidation state metal) (column 10, lines 29-30). The addition of a second repeating unit was discussed above.

Antoniadis also discloses that the reaction can be carried out in the presence of a catalytic amount of a divalent nickel salt (column 11, lines 23-26) (per claim 14).

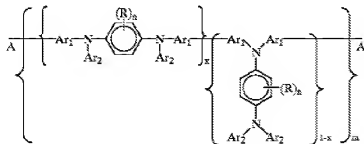
17. **Regarding Claims 2-3**, Antoniadis discloses in Formula A-1 that the R substituent on the phenyl linking group (called Ar2 by applicant) can be a C1-24 hydrocarbyl (alkyl) group (abstract).

18. **Regarding Claim 4**, Antoniadis discloses that the phenyl linking group which corresponds to applicants' Ar2. Ar1 of Formula A-1 can be an aryl group C6-18 which includes a phenyl group (abstract).

19. **Regarding Claims 5 and 9**, Antoniadis discloses that Ar2 in A-1 which corresponds to applicants' Ar3 can be substituted with C1-24 hydrocarbyl (alkyl) alkyl group (abstract).

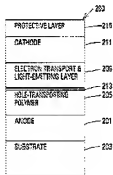
20. **Regarding Claim 10**, Antoniadis discloses the polymers are combined with at least one organic compound and functions as a hole conducting (transporting) layer (abstract).

21. **Regarding Claims 15 and 16**, Antoniadis discloses that Formula A-1 (shown above) can form a copolymer with a second aromatic monomer as shown below (abstract):



The reactions can be catalyzed by palladium and sodium t-butoxide (base) (column 10, lines 29-30) with A (LG, leaving group) being chlorine or bromine (column 9, line 50 and column 8, lines 43-44). The A (LG, leaving group) can also be boronic acid derivatives catalyzed by palladium (column 13, lines 22-25).

22. **Regarding Claims 17 and 19-20**, Antoniadis discloses that the conductive polymer composition can be used in an electroluminescent device (optical device) (abstract) (per claim 20). The hole conducting layer/hole transporting layer is formed from the poly (arylimine) (oligomer, per claim 17) (column 3, lines 65-66) (column 5, lines 1-3). The hole transporting layer is located between the anode and cathode(per claim19), see figure 1 below:



23. **Claims 21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Antoniadis (US 5,948,552) in view of Allen (US 6,858,703).**

24. **Regarding Claim 21 and 23**, Antoniadis discloses that the copolymers can be used in an electroluminescent device (abstract) but fails to mention a switching device.

Allen discloses that triarylamine polymers are used in optical sensor, switching devices and field effect transistors (column 83, lines 20-30).

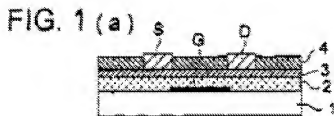
It would have been obvious to a person of ordinary skill in the art at the time of the invention to have used the electroluminescent device of Antoniadis in applications taught by the prior art which would have included the applications disclosed by Allen which reads on the instant limitations.

**25. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Antoniadis (US 5,948,552) in view of Allen (US 6,858,703) and further in view of Hirai (US 6,740,900).**

**26. Regarding Claim 22,** Antoniadis in view of Allen disclose triarylamine polymers used as a field transistors but fail to mention the structure of the device.

Hirai discloses that an insulator layer can be placed in various locations with respect to the gate, drain and source electrodes in an organic thin-film transistor.

Hirai discloses that the organic thin-film transistor contains a organic semiconductor layer 3, a gate electrode G, a drain electrode D, and a source electrode S that are in Figure I(a) shown below:



Hirai further discloses that a dielectric layer (field-effect transistor) serves as gate insulation layer 2 (column 7, lines 44-45). The above figure shows that the gate electrode G and the organic semiconductor layer 3 are both in contact with the gate insulation layer 2 located on side one. In addition, the above figure shows that the source electrode S and the drain electrode D are located on the organic semiconductor layer 3 on side two.

Hirai shows in the prior art that the claimed structure can be use as a field effect transistor.

With the reasonable expectation of success a person with ordinary skill in the art at the time of the invention would have selected from known field-effect transistor structures and readily substituted the conductive polymers disclosed by Antoniadis (K-2) for the organic semiconductive layer 3 disclosed by Hirai in Figure I (a) since the conductive polymers of Antoniadis would be functional equivalents to the polymers typically used to make an organic semiconductive layer.

### **Response to Arguments**

The examiner has addressed the limitations of claims 1 which were omitted from the previous office action. The basis of the rejections based on Towns has been changed as Towns does in fact teach substitution of the Ar1 and Ar2 aryl rings. As a result, applicant's arguments relative to Towns substitution of the Ar1 and Ar2 will not be addressed in this office action.

Applicant argues the heteroaryl groups in Towns Formula T-1 are not in scope with the limitations of claim 1.

The examiner counters that the claim language is open ended and allows for additionally compounds in applicants' Formula 1.

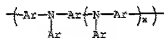
Applicant argues that Antoniadis only teaches triarylamine amine polymer but not copolymers with the second monomers.

While Antoniadis does not mention a second monomer as claimed by applicant, Bradley discloses that fluorene-triarylamine copolymers offer some advantages over a purely triarylamine based system. Bradley teaches that when N,N'-diphenyl, N,N'-bis(3-methylphenyl)-(1,1'-diphenyl)-4,4'-diamine (TPD) is combined with a more soluble polymer (fluorene based) the resulting copolymer is more processible and has a higher hole mobility (page 242). As Bradley teaches how such copolymer produce higher hole mobility than polymers with only the triarylamine component present, one could envisage adding a more soluble monomeric species to the polymers of Antoniadis to improve the processibility and promote higher hole mobility.

### Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure Towns WO 03/000773.

Towns discloses an arylamine oligomer represented by the following formula:



which may be substituted or unsubstituted, where x is 0 or 1 and each Ar is the same or different from the others and independently is a substituted or unsubstituted aryl or heteroaryl group.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GREGORY CLARK whose telephone number is (571)270-7087. The examiner can normally be reached on M-Th 7:00 AM to 5 PM Alternating Fri 7:30 AM to 4 PM and Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Larry Tarazano can be reached on (571) 272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/D. Lawrence Tarazano/  
Supervisory Patent Examiner, Art Unit 1786

GREGORY CLARK/GDC/  
Examiner  
Art Unit 1786